WHAT IS CLAIMED IS

Sub A1

1. An optical semiconductor device, comprising:

a substrate of SiC having a first conductivity type;

a buffer layer of AlGaN formed on said substrate epitaxially, said buffer layer having said first conductivity type and a composition represented by a compositional parameter x as $Al_xGa_{1-x}N$;

a first cladding layer having said first conductivity type, said first cladding layer being formed on said buffer layer epitaxially;

an active layer formed epitaxially on said first cladding layer;

a second cladding layer having a second, opposite conductivity type, said second cladding layer being formed on said active layer epitaxially;

a first electrode provided so as to inject first-type carriers having a first polarity into said second cladding layer; and

a second electrode provided on said substrate so as to inject second-type carriers having a second polarity,

said buffer layer containing said first type carriers with a concentration level in the range from $3 \times 10^{18} cm^{-3}$ to $1 \times 10^{20} cm^{-3}$ and said compositional parameter x larger than 0 but smaller than 0.4 ($0 < x < 0.4$).

2. An optical semiconductor device as

claimed in claim 1, wherein said substrate contains carriers of said first conductivity type with a concentration level in the range from $1 \times 10^{18} - 1 \times 10^{20} cm^{-3}$.

3. An optical semiconductor device as claimed in claim 1, wherein said compositional parameter x of said buffer layer is less than 0.09 ($x < 0.09$).

4. An optical semiconductor device as claimed in claim 1, wherein said substrate has a (0001)Si surface of SiC and wherein said buffer layer is formed on said (0001)Si surface in intimate contact with said substrate.

5. A method of fabricating an optical semiconductor device, comprising the step of: growing an AlGaN film having a composition of $Al_xGa_{1-x}N$ ($0 < x < 0.4$) on an SiC substrate by a metal-organic vapor phase epitaxy process, under a pressure of about 90 Torr or less.

6. An optical semiconductor device, comprising:

a substrate of SiC having a first conductivity type;

a buffer layer of AlGaN formed on said substrate epitaxially;

a first cladding layer of AlGaN having said first conductivity type, said first cladding layer being formed on said buffer layer epitaxially;

an optical waveguide layer of GaN having said first conductivity type, said optical waveguide layer being formed on said first cladding layer epitaxially;

an active layer formed epitaxially on said optical waveguide layer, said active layer containing Ga as a group III element and N as a group V element;

a second cladding layer of AlGaN having a second, opposite conductivity type, said second cladding layer being formed on said active layer epitaxially;

a first electrode provided so as to inject first-type carriers having a first polarity into said second cladding layer; and

a second electrode provided on said substrate so as to inject second-type carriers having a second polarity,

said substrate having a top surface separated from a bottom surface of said active layer by a distance of about 1.6 μm or more.

7. An optical semiconductor device as claimed in claim 6, wherein said buffer layer has a composition represented by a compositional parameter x as $Al_xGa_{1-x}N$, said first cladding layer has a composition represented by a compositional parameter y as $Al_yGa_{1-y}N$, and said second cladding layer has a

composition represented by a compositional parameter z as $Al_zGa_{1-z}N$, said compositional parameter x having a value equal to or larger than 0.08 but smaller than 0.5 ($0.08 \leq x < 0.5$), said compositional parameter y having a value equal to or larger than 0.05 but equal to or smaller than said compositional parameter x ($0.05 \leq y \leq x$), said compositional parameter z having a value smaller than said compositional parameter y ($z < y$).

8. An optical semiconductor device, comprising:

a substrate of SiC having a first conductivity type;

a first cladding layer having a first conductivity type, said first cladding layer being formed on said substrate epitaxially;

an active layer formed epitaxially on said first cladding layer;

a second cladding layer having a second, opposite conductivity type, said second cladding layer being formed on said active layer epitaxially;

a third cladding layer having said second conductivity type, said third cladding layer being formed on said second cladding layer epitaxially;

a first electrode provided so as to inject first-type carriers having a first polarity into said second cladding layer; and

a second electrode provided on said substrate so as to inject second-type carriers having a second polarity,

said third cladding layer having a ridge structure,

wherein an insulating film is interposed

between said second cladding layer and said third cladding layer, said insulating film having an opening in correspondence to said ridge structure, with a width smaller than a width of said ridge structure.

9. An optical semiconductor device as claimed in claim 8, wherein said contact layer covers a top surface and both side walls of said ridge structure continuously.

10. An optical semiconductor device as claimed in claim 9, wherein said first electrode covers a top surface and both side walls of said contact layer, corresponding respectively to said top surface and both side walls of said ridge structure, continuously.

11. An optical semiconductor device as claimed in claim 10, wherein said ridge structure is formed in a recess structure exposing said insulation film, and wherein said first electrode fills said recess structure.

12. An optical semiconductor device as claimed in claim 10 wherein said third cladding layer

is formed of a nitride of a group III element.

13. An optical semiconductor device, comprising:

a substrate of SiC having a first conductivity type;

a first cladding layer having a first conductivity type, said first cladding layer being formed on said substrate epitaxially;

an active layer formed epitaxially on said first cladding layer;

a second cladding layer having a second, opposite conductivity type, said second cladding layer being formed on said active layer epitaxially;

a third cladding layer having said second conductivity type, said third cladding layer being formed on said second cladding layer epitaxially;

a contact layer of said second conductivity type, said contact layer being formed on said third cladding layer;

a first electrode provided on said contact layer;

a second electrode provided on said substrate;

said third cladding layer forming a ridge structure having a T-shaped cross-section,

said third cladding layer including, at a bottom part thereof, a pair of cuts, such that said cuts penetrate from respective lateral sides of said ridge structure toward a center of said ridge structure.

14. A method of fabricating a semiconductor device, comprising the steps of:

forming an insulation pattern on a semiconductor layer such that said insulation pattern has an opening; and

forming, on said insulation pattern, a regrowth region of a nitride of Al and a group III element in correspondence to said opening,

said step of forming the regrowth region being conducted by an metal-organic vapor phase epitaxy process.

15. A method as claimed in claim 14, wherein said step of forming said regrowth region includes the step of admixing a halogen to a source material used in said metal-organic vapor phase epitaxy process for forming said nitride.

16. A method as claimed in claim 15, wherein said step of forming said regrowth region includes the step of supplying said halogen to a reaction chamber of a metal-organic vapor phase deposition apparatus, in which said metal-organic vapor phase epitaxy process occurs, separately to a gaseous source of nitrogen.

17. A method as claimed in claim 14, wherein said step of forming said regrowth region is

conducted by using a metal organic compound containing halogen.

18. An optical semiconductor device, comprising:

a substrate;

a first cladding layer of a nitride of a group III element formed epitaxially on said substrate, said first cladding layer having an n-type conductivity;

a first optical waveguide layer of a nitride of a group III element formed epitaxially on said first cladding layer, said first optical waveguide layer having an n-type conductivity;

an active layer of a nitride of a group III element formed epitaxially on said first optical waveguide layer;

an electron blocking layer of a nitride of a group III element formed epitaxially on said active layer, said electron blocking layer having a p-type conductivity;

a second optical waveguide layer of a nitride of a group III element formed epitaxially on said electron blocking layer, said second optical waveguide layer having a p-type conductivity;

a second cladding layer of a nitride of a group III element formed epitaxially on said second optical waveguide layer, said second cladding layer having a p-type conductivity;

a contact layer of a nitride of a group III element formed epitaxially on said second cladding layer, said contact layer having a p-type conductivity;

a first electrode provided on said contact

layer; and

a second electrode provided on said substrate;

each of said electron blocking layer, said second optical waveguide layer and said second cladding layer being doped by Mg;

wherein said second optical waveguide layer and said second cladding layer contain Mg therein with a concentration level lower than a concentration level of Mg in any of said electron blocking layer and said contact layer.

19. An optical semiconductor device as claimed in claim 18, wherein said second optical waveguide layer and said second cladding layer contain Mg with a concentration level not exceeding 4 x $10^{19}cm^{-3}$.

20. An optical semiconductor device as claimed in claim 19, wherein said electron blocking layer and said contact layer contain Mg with a concentration level exceeding 4 x $10^{19}cm^{-3}$.

21. A semiconductor wafer, comprising:

an SiC substrate having an n-type conductivity; and

an AlGaN layer having an n-type conductivity formed on said SiC substrate with a composition

represented as $Al_xGa_{1-x}N$,

wherein said AlGaN layer has a carrier density in the range between $3 \times 10^{18} - 1 \times 10^{20} cm^{-3}$, and

wherein said compositional parameter x is larger than 0 but smaller than 0.4 ($0 < x < 0.4$).

22. A semiconductor wafer as claimed in claim 21, wherein said substrate contains carriers of said first conductivity type with a concentration level in the range from $1 \times 10^{18} - 1 \times 10^{20} cm^{-3}$.

23. A semiconductor wafer as claimed in claim 21, wherein said compositional parameter x of said buffer layer is less than 0.09 ($x < 0.09$).

24. An optical semiconductor device as claimed in claim 21, wherein said substrate has a (0001)Si surface of SiC and wherein said buffer layer is formed on said (0001)Si surface in intimate contact with said substrate.